ipheral ends of the pneumogastrics; but, in warm-blooded animals, is due to action on the excito-motor ganglia of the heart, and in cold-blooded animals is due to action on the ganglia situated in the sinus venosus.

9. The main vaso-motor centre for strychnia is situated in the medulla oblongata, but simpler centres exist in the spinal cord.

10. The pneumogastric nerves are *not* paralyzed by strychnia, in either warm or cold-blooded animals.

11. Strychnia decreases the number of respiratory movements; at first from too little blood, and afterwards from too much blood flowing to the respiratory centres.

12. The decrease is not due to any action of the pneumogastrics.

13. Artificial respiration always moderates, and sometimes stops, the spasms; and this power is due to a maintenance of the oxygenation of the blood until the poison can be eliminated, and is not due to a reflex stimulation of the pneumogastrics.

ART. II.—THE DIAGNOSTIC SIGNIFICANCE OF THE TENDON REFLEX (KNEE PHENOMENON OF WESTPHAL).

BY H. M. BANNISTER, M. D., CHICAGO.

IN the *Archiv fuer Psychiatrie*, V., 1875, pages 492 and 802, Professors Erb and Westphal called attention to certain phenomena of contraction produced in muscles by percussion of their tendons, phenomena which, while some of them had long been matters of common observation, had received but little notice as regards their signification in health and disease. Erb found the patellar sinew reflex notably increased in several cases of spinal disease, *e. g.*, in three cases of compression of the cord, with or without myelitis, in consequence of decided spinal curvature; three cases of diffuse chronic myelitis, one of ataxia, etc. Westphal investigated the condition of

the patellar tendon reflex (knee phenomenon), and that of the tendo Achillis (foot phenomenon) in a large number of cases of hemiplegia and spinal disorder, and came to the conclusion, subject to still further proof, that it was always absent in well marked locomotor ataxia, and that whenever either the foot or knee phenomenon was present, that there could not be grey degeneration of the posterior columns in the lower dorsal and lumbar regions. A very little later Erb* published, under the title "A Little Known Spinal Symptom-Complex," an account of an affection corresponding very nearly, if not identical with the primary symmetrical lateral sclerosis of Charcot, in which as a characteristic symptom he mentioned an exaggeration of these phenomena. Besides several articles on the physiology of these phenomena, there have been several papers published on their clinical significance since the first publications of Erb and Westphal. Thus Henze,† in a rather comprehensive paper on these and other reflexes, confirms as far as he goes the statements of Westphal, and calls special attention to the point that in his observations of cases in which these phenomena were absent, there was also frequently cutaneous anæsthesia of the parts from which they can be excited. Then Westphal‡ himself, in an article on the diagnosis of grey degeneration of the posterior columns in paralytic insanity, reiterates his former statements and lays particular stress on the absence of the knee phenomenon in cases of dubious motor disorder of the lower extremities as indicating an affection of the posterior columns in the lumbar region. In still another communication§ he again calls attention to the significance of this symptom as an early symptom of locomotor ataxia, in such cases, for example, as those in which for a long time the pain is the only other symptom. In these cases, he says, the diagnosis may be made on this symptom alone, before any appearance of the ataxia or disorders of sensibility. The most recent clinical paper on the subject that we have seen is one by

* *Berliner klin. Wochenschr.*, June 28, 1875.

† *St. Petersburger med. Wochenschr.*, Oct. 30, 1876.

‡ *Archiv fuer Psychiatrie*, VIII., Hft. 2.

§ Ueber eines fruehes Symptom der Tabes Dorsalis. *Berliner klin. Wochenschr.*, 1878, No. 1. Abstr. in *Centralblattf. d. med. Wissensch.*, 1878, No. 26.

Muhr,* who gives his conclusions from an investigation of the knee phenomenon in fifty-one cases of general paresis. He finds it generally present in this affection, and agrees with Westphal in considering its absence as a positive sign of degeneration of the posterior columns, even in cases where no ataxia is observed.

If all these statements are correct, we certainly have in this knee phenomenon an important aid to diagnosis. But it is admitted by Westphal himself that it may be absent in perfectly healthy persons, a fact which very materially affects its value as such. Its absence cannot certainly be said to indicate disease in any part of the cord if it occurs in normal individuals. Nor can we ever be sure that it is not one of these exceptional cases that we have to deal with when we would make use of this sign in diagnosis, except in such individuals as we have a previous knowledge of in this respect. It does not appear, moreover, that the lack of the knee phenomenon in healthy persons is of such rare occurrence; in examining not over three dozen persons, two were met with by me, and one of these two was the first one examined. I have met with considerable variation in this patellar sinew reflex in normal individuals; besides the two mentioned in whom it could not be detected at all, there were others in whom it could be found only with difficulty and after several attempts, and still others who exhibited it to an almost exaggerated degree, the slightest tap on the sinew either above or below the patella producing the contraction. I have also thought I could perceive a considerable difference in this respect in the same individuals at different times.

Of the few cases of locomotor ataxia in which I have tested the patellar sinew reflex, in the majority it was absent, as in the cases of Westphal and others. In one rather curious case of ataxic symptoms limited to one-half of the body and resulting from intracranial disease, it was likewise absent. The following case however is apparently an exception, and therefore worthy of special mention in this connection:

The patient was from the country, and but one opportunity

* *Psychiatrisches Centralblatt*, No. 2, 1878. See PERISCOPE of this number.

for examination was afforded before he left the city and returned to his home; continued observation was therefore impossible.

T. N. F., American, sewing machine agent, aged 42, married, of good physical development, no family history of nervous disease, parents both living at an advanced age. No serious illness previously, excepting typhoid fever when eighteen and dysentery when twenty-three years old. In the winter of 1876 and 1877, some ten or twelve months or more before coming under observation, he had made a two weeks' trip in an open wagon and was much exposed. Subsequently he had undergone much mental worry about his business matters.

Some eight months or so before coming to me he began to notice a dull, heavy and numb feeling in the calves of the legs, and a special tendency to jerking of the lower limbs after going to bed. No pain was experienced at this time. This numbness gradually ascended his legs to the body to the intragluteal fissure, where it stopped. None was felt in front. With this he had all the time obstinate constipation, and soon began to have disorder of the innervation of the sphincters and slight dysuria. Had to assume a sitting posture when urinating; for a considerable time, could not control his bladder, either urinate when he wished to, or hold his water at times. At the beginning of his illness and just before, his sexual appetite was greatly increased. On a few occasions he also found difficulty in controlling his rectum and anal sphincter; it seemed at times as if he could not restrain himself, and then he would not be able to defecate for a considerable period.

Some six months before he was seen by me he had suffered for a time with severe neuralgic pains in his right eye. These were relieved by some treatment he thought, but could not give particulars. Possibly there was some inflammation, he thought. Had not slept well since the onset of his disorder, dreamed much, and waked often. Steadily getting worse in this respect. Had at no time any pain in the spinal cord, and mentioned no special feeling of constriction around the body at any point. Had always been temperate in living, neither

smoked, drank alcoholic liquors or used tea or coffee to any extent. Had always, however, been rather free in sexual indulgence.

Ataxic pains in the lower extremities had not been experienced up to the time I saw him, but he had felt them recently in his arms. Not very often, however. His mental power and memory were, he thought, somewhat weakened,

At the time of the examination he appeared well nourished; no atrophy was anywhere observable. No paralysis existed, but he complained of stiffness of his ankles, and was unable to walk any distance without fatigue. The co-ordination of the movements and the power of the upper members were good, his grasp seemed fully equal to that of other men of his age and stature; he carried the index of the dynamometer well around with either hand. In the lower limbs co-ordination was decidedly bad; he could not walk steadily or walk a line or bring his toes together without looking at them. Could walk with his eyes shut nearly, but not quite as well as with them open. There seemed to be weakness as well as inco-ordination, the leg was not thrown out with the force it is in some cases of ataxia. He staggered always to his left side, though his right leg was weaker than his left. The knee phenomenon was much exaggerated, and the contraction could be produced to some extent by percussion upon almost any point of the quadriceps muscle as well as upon the sinew.

The tactile sensibility was decidedly diminished in both legs, most in the right. The same could be said of the sensibility to pain and temperature. Muscular sense was impaired in both lower extremities; he could not always tell the position of his limbs or which leg he moved. Sensibility was apparently normal above the hips. Numbness has been already mentioned. All the special senses seemed normal except, perhaps, that of vision. The sight was good, but there appeared to be a partial color blindness, a dullness in the perception of certain colors. This may, however, have had no connection with his disorder. The ophthalmoscopic examination revealed nothing of interest; no paralysis of ocular muscles; pupils equal and reacting normally.

The digestion and appetite were good; the patient com-

plained much of sensitiveness to cold. Pulse ranged between 80 and 100. Sexual appetite diminished, but power, he thought, normal.

At the time, with my single opportunity for examination, I considered this as a rather aberrant case of locomotor ataxia; and, in spite of the statement of Westphal that the absence of the knee phenomenon is a useful diagnostic sign of tabes dorsalis when complicated with disease of the lateral columns, I was inclined, on account of the manifest weakness of the lower limbs and the great development of this phenomenon, to consider these latter as also implicated. The inco-ordination, loss of muscular sense, lack of pain in the cord, and to some extent the uro-genital and sensory symptoms, indicated locomotor ataxia, the trouble being located well down in the lumbar tract. The late appearing ataxic pains in the arms, and perhaps the neuralgic pains in the eye, the color blindness and the mental impairment, were evidences of the trouble much higher up in the cerebro-spinal axis. I feel well justified in considering that the posterior columns in the lumbar and lower dorsal region were diseased, and I cannot call it a case of simple myelitis. While it may perhaps be said that the morbid process in the lumbar cord had not reached the stage with which the symptoms of well marked locomotor ataxia generally appear, the case appears to me conclusive that it is not in all cases of that affection that the suppression of the patellar tendon reflex is an early symptom.

If we can find a case of typical locomotor ataxia with retained tendon reflex, it would be still more conclusive than the one detailed above, to prove that this phenomenon is not diagnostic of the disease. Such a one has very recently come under my observation, occurring in Dr. J. S. Jewell's practice, and which I owe the privilege of examining to his courtesy. It was a laundress, about forty years of age, who had had all the symptoms in a marked degree, the inco-ordination, ataxic pains, characteristic gait, etc., for several years before he first saw her in 1875. Then, for a period of several more years, she passed from under his care, and only recently came again under observation as a patient in Mercy Hospital in this city. At this time she had been suffering for about five weeks from an

acute attack of intercurrent spinal disease, a sort of acute ascending paralysis, which could hardly be called an aggravation of the long-standing disorder, but which undoubtedly had some connection with it. It commenced without apparent cause with suddenly appearing pains, and sense of constriction at the level of the upper abdomen, and almost simultaneously a feeling of weakness in the left leg. The paralysis extended to the other leg in a few days, making walking impossible. The sense of constriction rapidly ascended the thorax, and the paralysis likewise advanced, involving the sphincters, the abdominal muscles, and the muscles of respiration, in which condition she was when seen by Dr. Jewell. The state of affairs gradually became worse, the arms became paretic, speech and deglutition were made difficult, and after one or two short periods of apparent partial improvement the patient succumbed. No *post-mortem* was obtained. A few days before her death I was able to examine her, when the condition was about at the worst. Motor paralysis was complete to the upper portion of the thorax, respiration and speech were difficult, but sensibility was hardly more impaired than had been for several years previous to this acute attack. The knee phenomenon could be produced in an obvious degree by percussion of the tendon, the leg being slightly raised and supported in a partially flexed position as she lay in the bed. This was tested repeatedly and confirmed by both Dr. Jewell and myself.

It would not be justifiable to presume that the knee phenomenon so well developed in the latest stage of this patient's disease could have been altogether of recent date, having been suppressed during the previous years of the existence of the original disorder. Though the diagnosis was not confirmed by an autopsy, it was, nevertheless, as complete an *ante-mortem* one as could be made in any case, and was agreed in by several thoroughly competent physicians skilled in the diagnosis of nervous affection. If, therefore, the appearance of this phenomenon always depends upon a healthy condition of the posterior columns in the lumbar tract, the parts involved in locomotor ataxia affecting the lower limbs, then all the other characteristic symptoms of posterior spinal sclerosis in combi-

nation are not to be relied upon—certainly not the more probable of the two alternatives. The verification of the diagnosis by the autopsy would have been desirable, but its absence does not render the case inconclusive as to the presence of this symptom in well marked ataxia.

The generalization of Westphal, that this phenomenon is always lacking in cases of degeneration of the posterior columns in the lumbar region, appears to have been a purely empirical one. It is difficult, indeed, to see upon what physiological data it could be based with our present knowledge of the physiology of the symptom. It seems also to be contradicted by other observers: thus I may mention the case of "ataxia" noticed by Erb, in which it was exaggerated, and Leyden* has included this knee phenomenon among the motor phenomena of locomotor ataxia. The fact, however, that the diagnostic importance of its absence has been put forward so prominently, and under the sanction of so high an authority as Prof. Westphal, is, it seems to me, a sufficient excuse for offering the above evidence that, however infrequent it may be, this phenomenon is not *invariably* wanting in that disease.

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* Ueber die Betheiligung der Muskeln und motorischen Nervenapparate bei der Tabes dorsalis. *Deutsche Zeitschr. fuer prakt. Med.*, 1877, No. 49–51. Abstr. in *Centralbl. f. d. med. Wissensch.*, 1878, No. 20.

NOTE.—Since the above was written I have seen a report (*Brit. Med. Journal*, Aug. 31) of the discussion of a paper recently read before the British Medical Association, by Dr. Julius Althaus, on "Lateral and Posterior Sclerosis of the Spinal Cord," in the course of which Drs. Gowers, Sawyer, and Clifford Albutt stated that they had seen cases of posterior sclerosis in which this patellar tendon reflex was still present.